Model Predictive Control of an Underdamped, Pneumatically Actuated, Soft Robot with Flexible Links for Unmodeled Environments

Completed Technology Project (2014 - 2017)

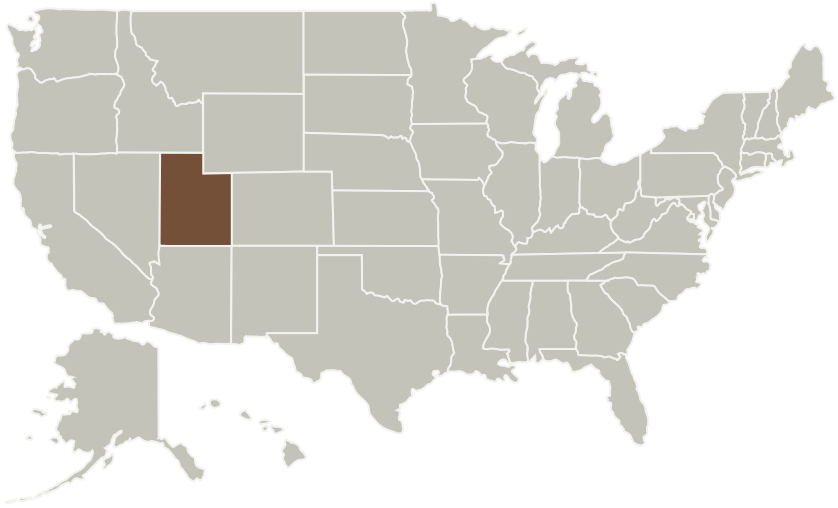
Project Introduction

Soft robots (made of compliant or soft materials) are often perceived as less capable when compared to traditional rigid robots. However, the proposed work will show that we can have compliant robots that are effective when operating in uncertain conditions while still having precise, high performance control for manipulation and mobility. In order to dramatically improve control for soft robots, we will initially develop optimal control methods on a 14 degree of freedom, pneumatically actuated, fabric-based, light-weight, mechanically robust robot torso and arms. This system is underactuated and underdamped, and we expect that advances in control for this platform will translate directly to systems with similar dynamics. Furthermore, the resilience of this platform to unmodeled collisions will enable us, as part of our proposed research, to develop algorithms for collaboratively working with other soft robots or people in harsh environments such as space. The platform on which we are developing our algorithms is light-weight, relatively inexpensive, and can be compactly stored for transportation. The result of our proposed work will be a set of control algorithms that will improve the overall performance and relevance of soft robots for future NASA missions.

Anticipated Benefits

The result of our proposed work will be a set of control algorithms that will improve the overall performance and relevance of soft robots for future NASA missions.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Brigham Young University-Provo	Lead Organization	Academia	Provo, Utah

Primary U.S. Work Locations
Utah

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Brigham Young University-Provo

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

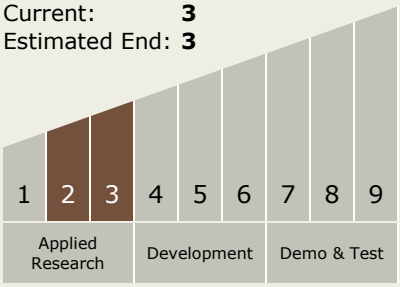
Hung D Nguyen

Principal Investigator:

Marc D Killpack

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.4 Human-Robot Interaction
    - TX04.4.2 Distributed Collaboration and Coordination

Target Destinations

Mars, Others Inside the Solar System, Foundational Knowledge